Space Weather Technical Forecast

Issued on Monday, 05 August 2024 at 01:18 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: M-class flares (R1-R2; Minor-Moderate radio blackouts) throughout. Chance of G1/Minor Geomagnetic Storm, mainly Day 1.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity is Moderate. A peak impulsive M-class flare was observed at 04/1515UTC from a newly emerging sunspot region in the southeast quadrant, numbered AR3780. An active disc, with thirteen sunspot regions currently visible. A number of these are magnetically complex, though largely benign in terms of flare activity at the moment. The weak shock from a Coronal Mass Ejection (CME) originating from AR3768 at 01/0709UTC may have arrived early on Day 1 (04 Aug), and there is evidence of one or two further CME arrivals affecting Earth through the past 24 hours..
Recently emerged AR3780 increasingly presents as a large, complex region with multiple spots and will be closely monitored as it rotates further into view. Near the southwest limb, AR3765, AR3767 and AR3770 will rotate out of view in coming hours. AR3772 in the southwest has lost the delta spot in one of its intermediate spots. AR3774 in the southeast quadrant has also lost its delta configuration. AR3777 has shown little recent change after signs of minor growth in its trailing spot. All other regions appear generally stable at present.

Solar Wind / Geomagnetic Activity: The solar wind has been at Slow-ambient to slightly elevated levels peaking at 420 km/s at 04/2132 UTC. Density has been at average to above average levels, peaking at 26pppc at 04/1331UTC. The Interplanetary Magnetic Field, Bt, was at Moderate to Strong levels, peaking at 22nT at 04/2229UTC, following the arrival of a relartively weak CME impact. The north-south component, Bz, was at Moderate to Strong levels with the southward orientation becoming most enhanced from 04/0600-1600UTC. Phi angle was largely positive (away from the Sun) before rotating into an negative (towards the sun) orientation from 04/0900 UTC. Geomagnetic activity was Quiet to Active (Kp 2-4) until 04/1200-1800UTC when geomagnetic activity became Moderate to Strong (Kp 6-7) for a time.

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux observed by GOES18 was at background levels. High energy electron flux (greater than 2MeV) observed at GOES16 was also at background levels. The 24-hour fluence was below the Active threshold with 8.85e5 integrated pfu observed at 05/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Moderate to High solar activity is forecast to continue, with occasional M-class flares expected and a chance of isolated X-class flares.

Solar Wind /Geomagnetic Activity: Solar winds are likely to continue at mostly Slow-ambient levels throughout, in the absence of any high speed streams (HSS) affecting Earth. Geomagnetic activity is likely to be generally Quiet to Unsettled (Kp 1-3), with Active to G1/Minor Storms (Kp 4-5) possible, more especially at first on Day 1 (5 Aug).

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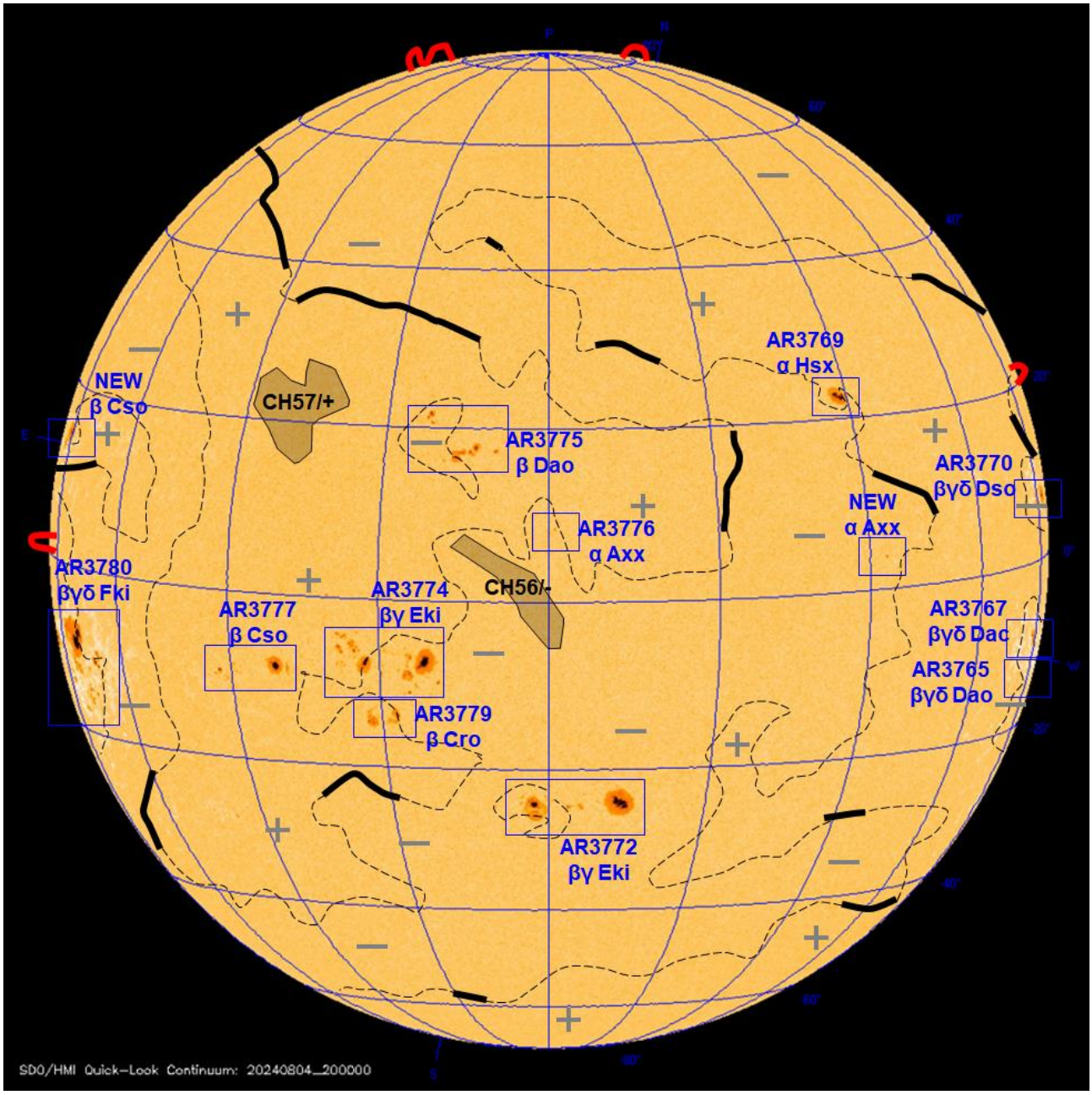
Met Office Space Weather Technical Forecast

Energetic Particles / Solar Radiation: High energy proton flux is currently at background levels. Should any notable flares occur, especially in the western disc there is a chance of exceeding the S1/Minor Radiation Storm threshold. The high energy electron flux is forecast to be at mostly background levels. The associated 24-hour fluence will probably remain below the Active threshold (1e8 integrated pfu) throughout.

Figure 1. Solar Analysis Valid 2000UTC, 4 August 2024.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

The bulk of a broad CME from the M8.2 flare at 01/0709UTC from AR3768 is largely passing ahead of Earth, as indicated by Enlil. However, SOHO coronagraph imagery showed a partial halo shock (not modelled in Enlil), which may have given Earth some weak glancing influence early on Day 1 (04 Aug).

Due to the large number of coincident CMEs in recent days, including those off the Earth-Sun line, analysis has been more difficult than usual. Consequently further arrivals appear to have affected Earth in the past 24 hours, although relatively weak. These observed around 04/1200 UTC, 04/2100 UTC and also possibly around 04/0600 UTC

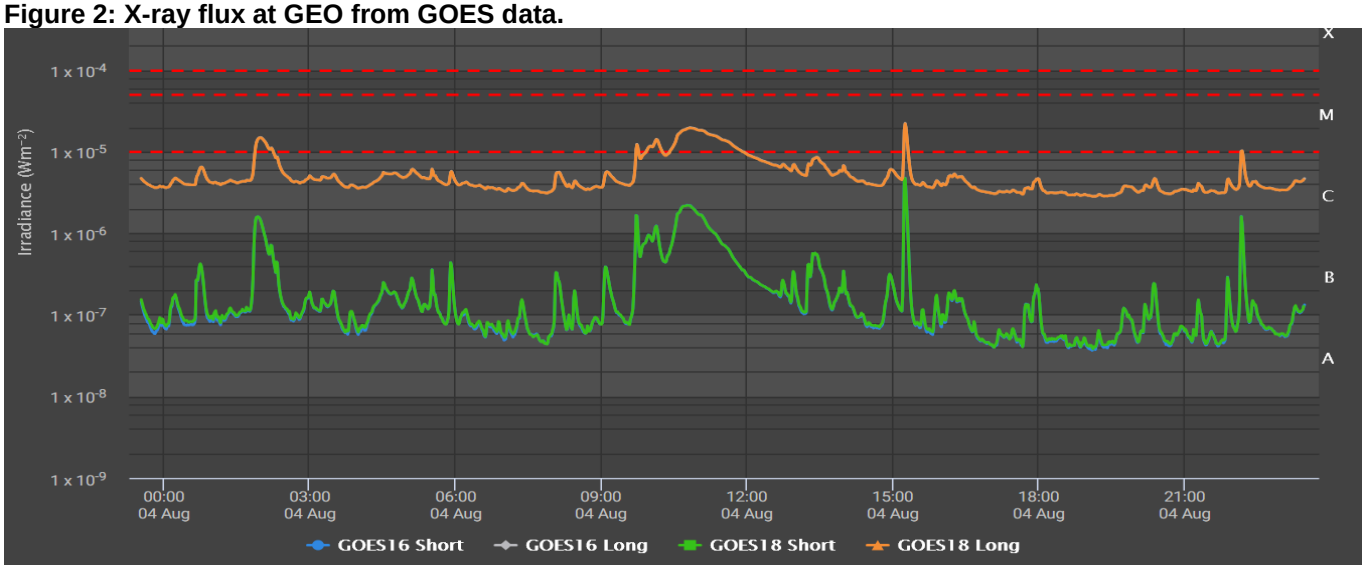
No coronal hole fast wind enhancements are expected during the period, with CME arrivals expected to be the main factor of interest. Geomagnetic activity is expected to be generally Quiet to Unsettled (Kp 1-3), with Active to G1/Minor Storms (Kp 4-5) possible, more especially at first on Day 1 (5 Aug).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	Yes	20	10	10	10
Strong	G3	Yes	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Nil.

Figure 2: X-ray flux at GEO from GOES data.



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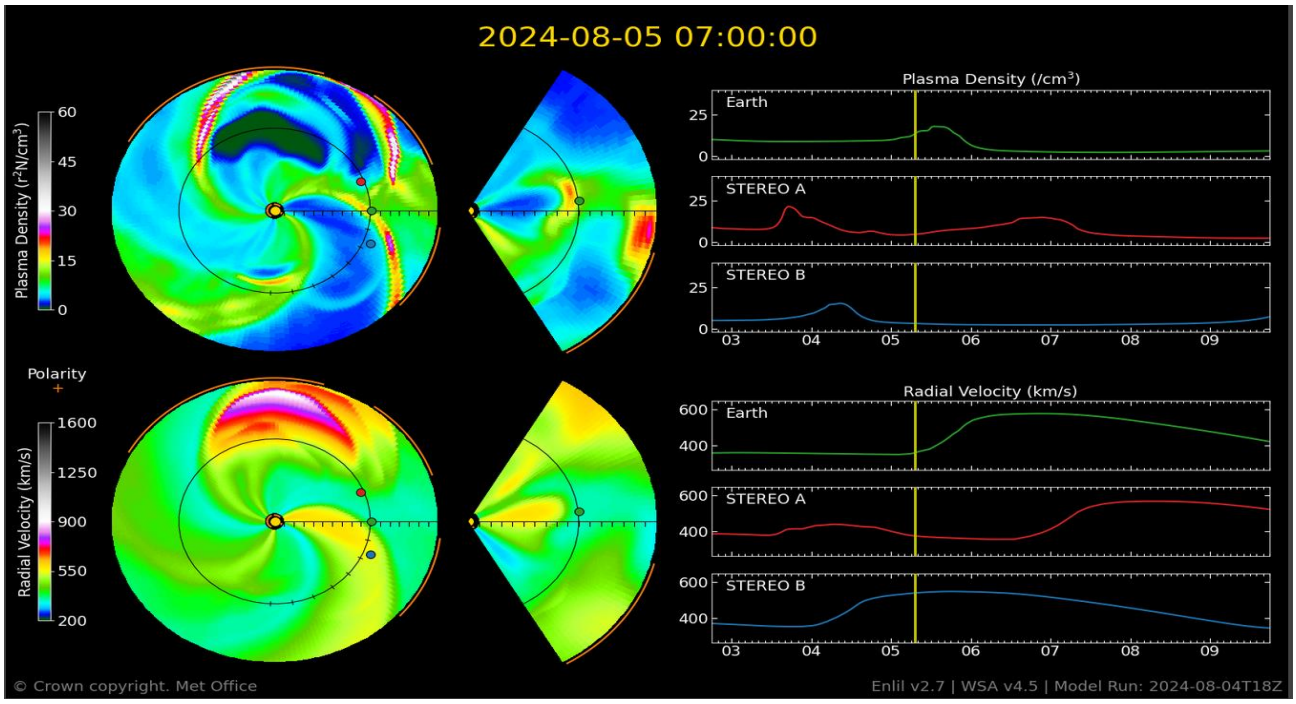
Radio Blackouts - X-Ray Flares:

There are 13 sunspot regions on the visible disc. Recently emerged AR3780 is large, magnetically complex with multiple spots and will be closely monitored as it rotates further into view. Near the southwest limb, AR3765 and AR3767 remain clustered close together. AR3772 in the southeast appears to be weakening but remains complex. AR3777 in the southwest has changed little. All other regions appear generally stable at present. The NEW region in the northeast may be ex3744 which was active on its last rotation.

Far-side sounding data suggests the potential for at least one significant oncoming region by the end of this guidance period. Provisionally a slight drop in flare risk is suggested through Days 2-4 (06-08 Aug) as the cluster of active regions in the west leave the disc, although oncoming regions could potentially balance this decline. Overall Moderate to High activity is forecast to continue, with occasional M-class flares expected and a chance of isolated X-class flares.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	80	70	70	70
Very Active	R3 to R5 X Class	No	20	20	20	20

Figure 3: Met Office ENLIL output. The high speed stream increase modelled on 05-06 Aug is low confidence, with no obvious coronal hole source for this feature.



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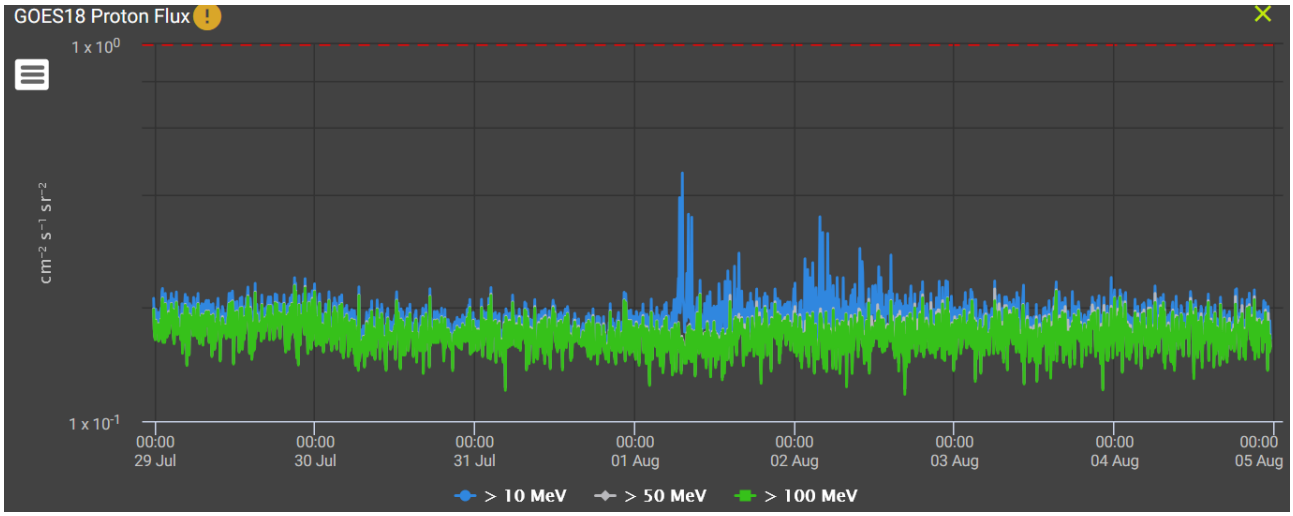
Solar Radiation Storms - (High Energy Protons):
High energy proton flux, as observed by GOES-18, is currently at background levels but has the potential to rise in response to any notable flares on the disc, particularly those from the west of the disc and therefore in a favourable position to give proton enhancement from any significant flare activity. This brings a chance of reaching the S1/Minor Radiation Storm level.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	20	20	20	20
Very Active	**≥ S3 ***	No	0	0	5	5
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Figure 4: High energy proton flux at GEO from GOES 18, over the past week.



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High Energy Electrons Event (≥ 2MeV):
High energy electron flux, as observed by GOES-16, is currently at background levels having been suppressed at GEO by the CME arrivals. In the abscence of HSSs observed flux will probably remain near background levels however this is balanced by the recent CME activity which is likely to have caused an increase in electron flux below GEO.

The associated 24hr electron fluence is most likely to remain below Active (1e8 integrated pfu).

GEO Electron Environment	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ $1x10^8$	No	1	1	1	1
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	1

Figure 5: High energy electron flux at GEO and REFM output from the Met Office.

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